

## SOIL SURVEY OF THE WICHITA AREA, KANSAS.

By J. E. LAPHAM and B. A. OLSHAUSEN.

### LOCATION AND BOUNDARIES OF THE AREA.

The area surveyed in Kansas comprises the southern half of the Wichita sheet, United States Geological Survey, and lies between the parallels of  $37^{\circ} 30'$  and  $37^{\circ} 45'$  north latitude and the meridians  $97^{\circ}$  and  $97^{\circ} 30'$  west longitude. It includes approximately 320 square miles in the southern part of Sedgwick County and 145 square miles in southwestern Butler County. Sedgwick County lies a little to the

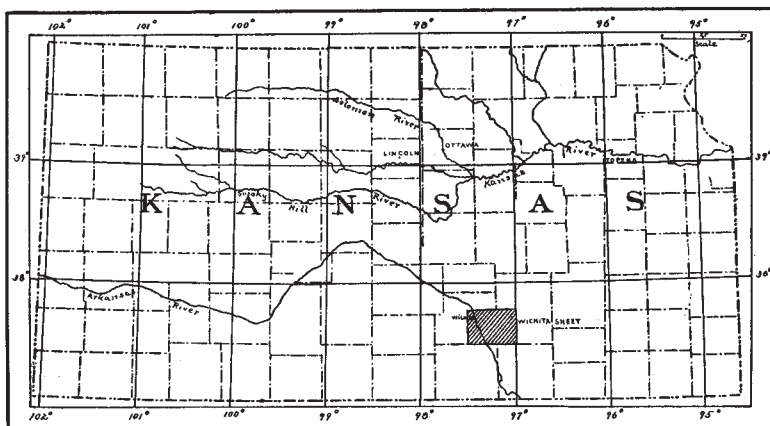


FIG. 18.—Sketch map showing area surveyed in Kansas.

east of a line drawn from north to south through the center of Kansas, and the southern limits of the area surveyed reach to within about 35 miles of the Oklahoma line. Wichita, the county seat of Sedgwick County, is the third city in size in the State and has a population of about 25,000. It has exceptionally good railroad facilities, and geographically is advantageously situated, standing as it does at the gateway to the rich agricultural districts of Oklahoma, Indian Territory, and northern Texas, the resources of which are only beginning to be realized.

## HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Probably the first white men to visit Kansas were Coronado and his adventurous band of Spanish gold seekers, who entered the State in 1541 and laid claim to the country by right of discovery. In 1682, ignoring the prior rights of Spain, the French flag was planted by La Salle at the mouth of the Mississippi River and the country named Louisiana. New Orleans became the French capital in 1718, and in 1722 the French established a fort on the Missouri River at the mouth of the Osage. In 1762 Louisiana was ceded by France to Spain, and in 1800 retroceded by Spain to France. The purchase from France of the Louisiana strip, which included all but a portion of southwestern Kansas, was made by the United States in 1803. The exploration of the newly acquired territory was immediately begun. The expedition of Lewis and Clark was started in 1804, followed in 1806 by that of Lieutenant Pike. In 1816, as commander of the United States topographical engineers, Major Long commenced an exploration lasting eight years. The great Santa Fe trail, over 700 miles long, was established about this time, and for many years continued to be the only avenue of commerce across the Great Plains. The first railroad to cross Kansas from east to west was the Union Pacific, which reached Denver in 1870. This was closely followed by the Santa Fe Railroad.

At the time of the purchase by the United States of the territory known as Louisiana there were four principal tribes of Indians living in it—the Osage, the Kansas or Kaw, the Pawnee, and the Padoucas. These tribes occupied lands in the eastern part of Kansas and in Missouri. The early boundaries of the Indian Territory, surveyed in 1830, included the greater part of the State of Kansas, and into this territory the removal of the Indians had begun as early as 1824. The lands in the vicinity of Wichita were used as a hunting ground by the Osage tribe, but they practiced little or no agriculture in that part of Kansas. In 1863, consequent upon the disturbances of the civil war, the Wichita were driven from their more southern territory and camped near the present site of Wichita, at the junction of the Arkansas and the Little Arkansas Rivers, where they engaged in agricultural pursuits of a primitive nature until 1867, when they returned south. At that time buffalo roamed the plains in vast numbers, and as early as 1860 a few pioneers came into the country and engaged in the fur trade with the Indians. The first of these to become a permanent resident of Sedgwick County was Hon. J. R. Mead, who went to Wichita in 1863. In 1867 a strip of territory which included Sedgwick County was opened for settlement, but it was not until the next year that the real agricultural development began. In this year several pioneers bought lands along the streams and engaged in general farming, while others, taking advantage of the rich natural

grasses of the prairie, turned their attention to cattle raising. Sedgwick County was organized in 1870, and from this time on many settlers were attracted to the fast developing country. A great many cattle were at this time driven up from Texas through Sedgwick County to Abilene, where they were fattened and shipped to eastern markets. In 1872 a branch of the Santa Fe Railroad was completed from Newton to Wichita, and for several years thereafter the latter city was the shipping point for thousands of head of cattle driven up from the ranges of the Southwest.

The principal products of Kansas have always been corn, wheat, and cattle, and from the earliest settlement of the country it is to these staples that the attention of the farmers of Sedgwick and Butler counties has been turned. Nearly all the fruits and vegetables have from the first been grown for home consumption, though little attention was formerly paid to their shipment to other markets. Despite the great fertility of the soils, the history of the early agriculturist has not been one of uninterrupted prosperity. Considerable hardship has at times been entailed by reason of severe droughts, and the settler has suffered greatly in former times from the visitations of grasshoppers. Education has received special attention from the beginning of Kansas history, and the facilities afforded in the primary schools and institutions of higher learning are excelled by those of few other States. In the regular attendance at schools, in proportion to the population, Kansas boasts of first position among the States of the Union. Wichita offers abundant facilities for the education of her children, and, besides her ward schools, possesses three or four well-patronized preparatory colleges.

#### CLIMATE.

The following table, compiled from records of the Weather Bureau stations at Wichita and Mounthope, shows the normal temperature and precipitation of the area. It will be noticed that the rainfall is heaviest during the growing season, and is usually sufficient for the proper maturing of the crops grown. A marked falling off in the monthly precipitation begins in November and continues through the winter months.

*Normal monthly and annual temperature and precipitation.*

Month.	Temperature.		Precipitation.	
	Mount-hope.	Wichita.	Mount-hope. <sup>a</sup>	Wichita.
	° F.	° F.	Inches.	Inches.
January .....	31.5	32.3	0.20	0.92
February .....	35.3	32.2	1.38	1.29
March .....	41.4	44.9	.53	1.87
April .....	57.1	57.5	4.20	2.95
May .....	66.5	65.1	1.44	4.27
June .....	78.7	74.6	1.33	4.97
July .....	81.3	78.8	1.37	3.21
August .....	78.4	78.1	1.56	3.02
September .....	70.9	70.5	4.04	2.91
October .....	54.8	59.4	4.80	2.40
November .....	42.1	43.9	.53	1.05
December .....	35.1	36.6	.38	1.00
Year .....	58.0	56.2	21.76	29.86

<sup>a</sup> Figures are actual precipitation for the year 1901; normals have not yet been established for this station.

The growing season for tender vegetation covers a period of about one hundred and sixty-five days, the average date of the last killing frost in spring occurring in the latter part of April and the earliest in fall between the 1st and 15th of October.

As stated, the figures given in the table of temperature and precipitation are normals, with the exception noted, and indicate the average of probabilities. They do not show extremes of temperature nor the periods of severe drought that sometimes occur. The droughts are often accompanied by scorching winds from the more arid country to the west and south, and at such times the crops shrivel in the fields. The frequency and severity of such periods are, of course, greater in the more western part of the State.

## PHYSIOGRAPHY AND GEOLOGY.

The area embraced in the Wichita sheet lies at an elevation of from 1,250 to 1,400 feet above sea level, and in topography is a rolling prairie, the otherwise treeless monotony of which is relieved by the presence along the few shallow streams of a moderately thick growth of cottonwood, walnut, and a few other indigenous trees. The greater portion of the upland is marked by low, smoothly rounded, and gently undulating billowy ridges or crests, the tops of which are scarcely ever more than 20 feet (usually much less) above the troughs of the swells. These swells are from a few hundred yards to half a mile or more apart, usually follow approximately parallel lines, and generally trend in a direction slightly west of north and east of south. This contour more often gives a level sky line looking to the east or west than to the

north or south. Occasional nearly flat expanses of upland are met covering several square miles, standing in the center of which one is at a loss to determine in which direction the surface slopes. It is one of the peculiar phenomena of the prairie country that no matter where one stands a higher vantage ground appears to lie just beyond, which, when reached, proves to have no greater elevation than the previous station. A somewhat peculiar sensation is experienced upon finding oneself standing in the bottom of a shallow, amphitheaterlike depression, the descent into which has been so gradual as not to have been appreciated, and to suddenly find the distant view cut off on two or three sides by a rim of the prairie which forms the sky line a half mile to a mile distant.

A prominent feature of the physiography is the Arkansas River Valley, which crosses the western part of the area in a general south-southeasterly direction. It ranges from 4 to  $6\frac{1}{2}$  miles in width, and comprises about 85 square miles of land surface. The present river channel is from 100 to 200 yards wide, and through the loose, constantly shifting sands of this river bed the stream, some 25 to 50 yards in width, threads its way. The river at its normal level is very shallow, and it is only when reenforced by local rains or by freshets due to rains and melting snows at its Colorado source that it occupies the full width of the channel. It occasionally then overflows its banks and extends to some distance into the valley beyond. Much less water is said to come down the Arkansas than formerly, the loss being due in part, no doubt, to the extensive irrigation at present practiced in eastern Colorado. The valley reaches its greatest width ( $6\frac{1}{2}$  miles) in the northern part of the area. The western border of it is characterized by the presence of loose sands, the well-rounded grains of which consist of quartz and feldspar. Part of this material has been transported from the upper reaches of the river, and perhaps some of it has come from the near-by Tertiary deposits of the uplands, which in the northern part of the area form a low, well-defined escarpment extending for a few miles along the valley plain. Farther to the south this escarpment in many places becomes obliterated and the junction of the upland with the valley is not well defined. The topography of that part of the river valley covered by the heavier soils is quite flat, but the sands are often drifted into low dunes of from 2 to 6 feet in height. Dunes in the process of rapid formation are often seen on the leeward side of the osage-orange hedges.

The Little Arkansas River, rising about 80 miles north and emptying into the "Big" River at Wichita, substantially increases the volume of the larger stream. Were it not for this accession there would be little water in the main channel during the drier portions of the year.

Besides the two streams mentioned, the area is watered and drained by Cowskin Creek, a small, sluggish stream lying to the west of and

flowing nearly parallel to the Arkansas River, of which it is a tributary. The Walnut River and its tributaries, Fourmile and Eight-mile creeks, together with the Whitewater River, drain the eastern half of the area, the watershed between the Arkansas and the Walnut River lying about 6 miles to the east of the former. Tributary to these principal smaller streams are a number of "draws," or shallow ravines, which furnish immediate drainage to the uplands. The Walnut River is quite an important stream, and in the vicinity of Douglass has eroded a valley from 1 to 2 miles wide, with the formation in the area of from 10 to 12 square miles of rich alluvial soil. The west bank of this stream is formed by bluffs of partially degraded limestone, rising to the height of about 75 feet from the river level. Nearly all of the bottom land lies on the east side of the river.

The results of the geological studies and investigations of Hay, Prosser, Haworth, and others show the Permian or Permo-Carboniferous to be the most extensive and important formation in the area. The bed rock is quite thickly covered with residual soil, modified in some localities by later deposits, but outcrops in the neighborhood of Douglass and along the eastern border of the area show it to consist of rather soft yellowish to grayish limestone, interbedded with usually light-colored shales. In this locality considerable quantities of chert are included in the limestone. The influence of this chert is manifested in the topography of the country, where, in a few instances, small knobs of it are left elevated above the level of the surrounding plain. On the west bank of the Walnut, 4 miles north of Douglass, are a few small, buttelike mounds rising abruptly above the surrounding hills. These are composed of a yellowish-brown crystalline limestone which has resisted the agencies of weathering to a greater extent than the remainder of the rock. The rock is quarried to some extent, and furnishes a fair grade of building stone. There are limestone outcrops also at a few points to the east, and in the near vicinity of Wichita, but these are not prominent, while on the west side of the Arkansas River this formation is so far weathered that the rocks are seen in place in but one or two localities, notably along Spring Creek. Two of the loams of the area are derived from the weathering of this limestone formation, and it is probable that one of the other loams is modified by it. The main type, Sedgwick clay loam, seems to be produced directly from its degradation.

On the west side of the Arkansas River Valley, especially in the northern part of the area, unconsolidated material referred to the Tertiary era is found to be extensive. This material ranges in consistency from a clayey sand to a sandy clay. The sand runs from fine to coarse in texture, is red in color, and consists mainly of grains of feldspar and quartz. A boring occasionally shows a coarser textured sand, grading into a fine gravel, grayish in color, and sticky with a cement of lime. The actual contact between this Tertiary formation

and the Permian was discovered in but one or two places. In section 17, Ohio Township, calcareous shales are exposed along Spring Creek, and in one of the draws about 2 miles to the east of this exposure shale is also seen. An outlier of the tertiary is encountered in the vicinity of Fairmount College, east of Wichita. This also rests upon the Permian. In a cut on the Frisco Railroad, in this locality, are seen masses of pure white lime deposit of chalky consistency. This material is also encountered in borings in the vicinity.

Along the Arkansas River, south of Wichita, in the townships of Gypsum and Rockford, well-defined exposures of loess are seen. In sec. 10, R. 1 E., Gypsum Township, this silty material overlies shale and a coarse, highly calcareous, light-gray sandstone. The loess at this point is about 20 feet thick. South of Derby, at the extreme edge of the map, it attains a thickness of about 40 feet. The most easterly exposure of the loess discovered is along Spring Creek, 3 miles northeast of Derby. The material here contains scattered lumps of crystallized gypsum and overlies limestone of an evident mud-flat formation. The loess is heavy in texture, and the soil which it forms so closely resembles the residual soil of the limestone that its influence is not perceptible for a much greater distance than 3 miles from the river.

A few exposures of a dark, slaty gray impure gypsum are found on the upland a few miles east of Wichita. The water from the wells in this locality is in some instances so strongly impregnated with it as to be unfit for domestic use. This mineral is not present to such an extent, however, as to greatly influence the soils.

#### SOILS.

Nine soil types have been recognized and mapped in the area. The types are described in the order of their areal importance. Six of the types are found on the upland—Sedgwick clay loam, Derby loam, Sedgwick loam, Clarksville stony loam, Sedgwick black clay loam, Sedgwick sandy loam. The three remaining types which occur in the Arkansas River Valley are the Arkansas loam, Miami sand, and Miami fine sand.

The following table gives the area of each type in acres and the proportion which each forms of the entire area:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Sedgwick clay loam.....	136,320	45.8	Sedgwick black clay loam	5,568	1.9
Sedgwick loam .....	47,040	15.8	Clarksville stony loam ....	4,352	1.5
Arkansas loam .....	45,568	15.3	Sedgwick sandy loam.....	3,136	1.0
Derby loam .....	20,416	6.9	Total .....	297,536	.....
Miami sand .....	19,392	6.5			
Miami fine sand.....	15,744	5.3			

## SEDGWICK CLAY LOAM.

The Sedgwick clay loam, to an average depth of about 9 inches, consists of a friable silty loam, ranging in color from a chocolate brown to a dark brown. It possesses an even uniform texture, and when rubbed between the fingers feels more clayey than silty. Following rains there is a tendency to the formation of a thin crust at the surface, but this is easily broken and does not offer much resistance to the penetration of the soil by vegetation. When wet the soil is very sticky, and until it has become fairly dry cultivation is difficult, because the tools do not "scour" readily. Clods are also apt to form. The subsoil, to the depth of 18 or 20 inches, grades from a heavy brown clay loam to a dark-brown clay of a cuboidal fracture, sometimes locally called "joint clay." From 20 to 36 inches the subsoil becomes somewhat looser in structure, as well as more silty in texture, a little lighter in color, and occasionally contains a few small concretions of lime. At a depth of 30 to 36 inches the subsoil is at times exceedingly tough, rather dry, and contains a good deal of iron in the shape of small, very dark metallic brown concretions. At this zone the soil grains are, if anything, inclined to be coarser, the toughness being due to the presence of the iron. The subsoil of this type is very variable, however. On the west side of the Arkansas River in some localities it is more or less modified by the later Tertiary deposits, and occasionally contains a very small amount of sand; in the western part of the area, in the vicinity and to the north of Rosehill, while retaining the same characteristic jointed structure, the subsoil is much mottled with a light-drab clay; in Butler County, near the Walnut River, where the parent rock is nearer the surface, both soil and subsoil are lighter and redder in color and the structure of the subsoil slightly looser. These variations have been deemed too slight, however, to warrant making separate soil types of the different phases.

The greatest extent of this soil is found in the eastern third of the area, on a high, rolling prairie. These areas are well drained by a few small streams and the many draws or shallow ravines tributary to them. In only a few instances, on flat hilltops, is artificial drainage necessary. The natural forest is mainly cottonwood, which grows along the banks of the streams.

The soil is derived from the weathering of the carboniferous limestones and shales. It seems well adapted to the production of corn and wheat, the average yields of the former being, one year with another, about 20 bushels; of the latter, 15 bushels per acre. Scattered about over the area several square miles of the natural prairie grasses are still seen growing, which furnish excellent pasturage and a good quality of hay for winter use. The subsoil is rather too heavy for the successful growing of alfalfa, but considerable Kafir corn is

yearly harvested. Fruit trees show a sturdy growth, and the yield of fruit is abundant, though it is not grown to any extent for market. Nearly all kinds of vegetables yield well and are grown in sufficient quantities for home consumption.

The following table shows the mechanical analyses of the soil and subsoil of three samples of the type:

*Mechanical analyses of Sedgwick clay loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
6915	N. $\frac{1}{2}$ sec. 27, T. 28 S., R. 1 W.	Dark-brown silty loam, 0 to 11 inches.	P. ct. 2.66	P. ct. 0.36	P. ct. 2.14	P. ct. 2.04	P. ct. 2.90	P. ct. 10.20	P. ct. 74.30	P. ct. 7.94
6917	SW. $\frac{1}{4}$ sec. 34, T. 28 S., R. 1 W.	Reddish-brown silty loam, 0 to 10 inches.	3.07	.14	1.54	2.32	5.28	10.40	65.78	14.16
6913	SW. $\frac{1}{4}$ sec. 18, T. 29 S., R. 4 W.	.....do .....	2.86	.18	.74	.70	1.34	10.28	71.26	15.50
6918	Subsoil of 6917.....	Heavy brown loam to clay loam, 10 to 36 inches.	1.05	.16	.88	.74	1.66	4.94	77.38	14.14
6916	Subsoil of 6915.....	Brown clay loam, 11 to 36 inches.	1.00	.12	2.18	2.00	2.62	6.34	70.12	16.08
6914	Subsoil of 6913.....	Heavy clay loam, 10 to 36 inches.	1.14	.10	.64	.48	1.12	8.80	68.18	20.34

#### DERBY LOAM.

The surface soil of the Derby loam is a friable, mellow, yellowish-brown to reddish-brown silty loam, containing a very small proportion of very fine sand, and extending to the depth of about 10 inches. It is very uniform in both texture and structure, and grades almost imperceptibly into the underlying subsoil. The subsoil, at a depth of from 10 to 36 inches, contains slightly more fine material and the grains are somewhat more compact in their arrangement. Along Spring Creek, near Derby, a strip of "second bottom" occurs, aggregating a little over a square mile in extent. The soil is here slightly coarser and looser, and has been classed with the Derby loam, as resembling it much more closely than the alluvial type of loam elsewhere described.

The soil is easily cultivated, does not bake or clod, and has excellent drainage. It is an upland soil, and is found typically developed along the east bank of the Arkansas River, south of Wichita. It forms 6.9 per cent of the area. It is derived from the weathering of a fine, compact loess deposit overlying the Permian limestone. Its contact with the residual soil of this limestone, at its eastern boundary, is not sharp, the soils grading almost imperceptibly into each other.

It is one of the best soils of the area for general agricultural purposes, being excellent wheat and corn land. The average yield of wheat is about 18 bushels, of corn 25 bushels, per acre. With the use of the subsoil plow it is thought that alfalfa might do well.

The following table gives the mechanical analyses of the type:

*Mechanical analyses of Derby loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.06 mm.	Silt, 0.06 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
6899	SE. $\frac{1}{4}$ sec. 1, T. 29 S., R. 2 E.	Yellowish-brown silty loam, 0 to 12 inches.	2.73	0.86	2.00	0.12	5.84	29.18	44.86	17.24
6901	W. $\frac{1}{4}$ sec. 7, T. 28 S., R. 2 E.	Brown silty loam, 0 to 11 inches.	3.16	.70	2.30	2.34	8.70	26.02	39.06	20.64
6900	Subsoil of 6899.....	Yellowish silty loam, 12 to 36 inches.	1.18	.10	.44	.68	2.26	21.20	58.00	17.30
6902	Subsoil of 6901.....	Silty loam, 11 to 36 inches.	1.31	.40	3.74	4.68	16.34	20.96	31.28	22.28

#### SEDGWICK LOAM.

The Sedgwick loam is a fine, mellow reddish-brown loam to a depth of 10 inches. It often contains a small percentage of fine sand. The subsoil consists of a somewhat tough reddish loam, which at from 24 to 36 inches grades into a tenacious red sandy clay, the grains of which are composed mainly of feldspar and quartz. The soil is friable and easily cultivated. The type is principally found in the northwestern part of the area, though a few square miles occur in the southwestern portion. Altogether, it constitutes 15.8 per cent of the area. The topography of this type is that of a slightly rolling prairie, which in general is very well drained. Little artificial drainage is required. The soil is derived from an unconsolidated material, consisting of clay and sand, of Tertiary age. In places it is more or less modified by the underlying residual limestone soil. It is a strong, easily handled soil, suitable for the ordinary farm crops, such as corn, wheat, oats, and Kafir corn. Its value for alfalfa has not been tested to any extent, but it is thought that this forage plant might do well on it once a fair catch was secured.

The texture of samples of the soil and subsoil is shown in the table on the succeeding page.

*Mechanical analyses of Sedgwick loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
6907	S. $\frac{1}{4}$ sec. 3, T. 28 S., R. 1 W.	Brown silty loam, 0 to 10 inches.	<i>P. ct.</i> 1.28	<i>P. ct.</i> 0.04	<i>P. ct.</i> 2.48	<i>P. ct.</i> 3.06	<i>P. ct.</i> 4.54	<i>P. ct.</i> 10.60	<i>P. ct.</i> 72.54	<i>P. ct.</i> 6.74
6909	W. $\frac{1}{4}$ sec. 25, T. 28 S., R. 1 W.	Reddish-brown loam, 0 to 10 inches.	1.89	.34	5.24	9.46	12.12	11.64	50.84	9.30
6911	NE. $\frac{1}{4}$ sec. 14, T. 27 S., R. 1 E.	Dark-brown loam, 0 to 10 inches.	3.46	.72	2.94	3.96	10.24	13.00	55.48	13.54
6912	Subsoil of 6911.....	Heavy loam, 10 to 72 inches.	.50	1.46	3.64	3.76	9.54	12.72	55.96	12.92
6910	Subsoil of 6909.....	Reddish-brown loam to red sandy clay, 10 to 36 inches.	.77	.90	7.26	11.24	15.40	10.16	40.88	13.54
6908	Subsoil of 6907.....	Brown silty loam, 10 to 36 inches.	1.70	.06	1.56	1.68	2.73	4.92	72.94	15.20

## ARKANSAS LOAM.

The soil of this type is a very dark brown loam, fine grained and mellow, and about 10 inches in depth. In poorly drained spots it is inclined to be a little heavy and sticky, while in areas where it lies in close proximity to the dunes of the Arkansas River it is often modified by wind-blown sand, and partakes somewhat of the nature of a sandy loam. The subsoil, to a depth of from 10 to 24 inches, is composed of a grayish-brown mixture of clay and silt, or very fine sand. The clay in this sometimes predominates so that the texture is quite heavy, and again the fine sand may be more abundant than the clay. In the typical section, from 2 to 3 feet below the surface, the subsoil is made up of interstratified layers of sand, medium to fine in texture, and clay, which is sometimes calcareous, or contains small concretions of lime. Below 3 feet strata of loose, incoherent yellow sand, of a few inches in thickness, are encountered. Along the course of Big Slough, in the northwestern part of the sheet, an area of 2 or 3 square miles exists in which the soil is thinner and the subsoil distinctly more sandy. In the townships of Waco and Salem a small strip of similar character is found extending nearly parallel to and connecting with the Arkansas River.

The soil is found in a typical state of development in the Arkansas River Valley, in the city of Wichita, and vicinity. It is also present along nearly all the streams in the area, though in some instances its characteristics are there somewhat modified. In the Walnut River bottom, in the vicinity of Douglass, the subsoil is usually darker in

color and slightly finer in texture than along the Arkansas River, and there is an almost complete absence of sand.

The soil is alluvial in origin, having been brought down as a river sediment and deposited in its present position. It occupies a level position from 6 to 15 feet above the streams, and a part of it is subject to almost annual inundation. It is necessary in some localities to resort to artificial means to secure sufficient drainage. In the north-eastern part of Waco Township the drainage is particularly poor over an area having its northern limit in the suburbs of Wichita, and containing altogether 3 or 4 square miles. Alkali salts rise to the surface to some extent in this locality in the summer time, and in some small spots have destroyed the vegetation. This area is used wholly for pasturage. The most extensive natural forest growth in the county occurs on the Arkansas loam, and consists of cottonwood, walnut, elm, hackberry, and box elder.

The agricultural interests of the area covered by this type include nearly all of the ordinary farm crops, though wheat is not grown to such an extent as upon the upland. The soil is particularly well adapted to alfalfa because of the comparative ease with which the roots can penetrate the subsoil, and also because the level of standing water is relatively near the surface. Potatoes and other vegetables do well, grapes give excellent yields, and other fruits are grown with profit.

The texture of the soil and subsoil is exhibited by the following analyses:

*Mechanical analyses of Arkansas loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
6891	S. $\frac{1}{2}$ sec. 22, T. 27 S., R. 1 E.	Dark brown loam, 0 to 10 inches.	3.19	0.20	1.20	2.52	7.38	19.60	59.84	9.06
6889	S. $\frac{1}{2}$ sec. 10, T. 29 S., R. 1 E.	Silty loam, 0 to 11 inches.	2.46	.04	1.42	4.06	17.48	20.08	42.44	14.04
6887	W. $\frac{1}{2}$ sec. 20, T. 29 S., R. 4 W.	Silty loam, 0 to 12 inches.	2.77	.14	.58	.50	1.08	21.64	60.26	15.92
6890	Subsoil of 6889.....	Sandy loam, 11 to 36 inches.	.86	.42	1.36	2.70	13.56	23.36	48.66	9.26
6888	Subsoil of 6887.....	Black clay loam, 12 to 36 inches.	1.04	.26	.36	.44	.80	3.74	51.42	42.74

MIAMI SAND.

The Miami sand, to a depth of 14 inches, is a loose yellowish-brown sand, medium to coarse in texture. The subsoil is coarser in texture,

and is in great part made up of reddish grains of feldspar, mixed with quartz, so that the prevailing color is a reddish yellow. The majority of the material of the subsoil is loose and incoherent, though layers of slightly sticky sand are sometimes encountered at depths varying from 2 to 3 feet. At from 4 to 6 feet the subsoil occasionally grades into a fine gravel consisting of well-rounded particles of quartz and feldspar.

This type of soil occupies the western side of the Arkansas River Valley, and occurs as a strip from 1 to 2 miles wide and about 14 miles long. It is separated from the river by the Miami fine sand, which it closely resembles in appearance, having the same general level topography, varied in many places by the presence of low, dunelike hillocks of wind-blown sand from 2 to 5 feet in height. The drainage of the soil is perfect, except for a small part of it lying adjacent to the Big Slough, in Delano Township, in which locality the water is quite close to the surface in the spring and early summer.

Miami sand is derived from material transported by the Arkansas River. Much of this was probably brought down from extensive deposits of Tertiary age in eastern Colorado during a time when the flood plain of the Arkansas was much wider than at present, or at least when the stream flowed at the western side of its valley, and it may also be that a part of the material is derived from the weathering of the near-by Tertiary deposits and has not been carried any great distance.

The soil is adapted to corn, alfalfa, and fruit. Several large apple orchards on this sand are yielding abundantly, and it also finds favor among melon growers. It is also an excellent soil for early truck growing.

The following table gives mechanical analyses of typical samples of this soil:

*Mechanical analyses of Miami sand.*

[Fine earth.]

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
6925	S. $\frac{1}{2}$ sec. 26, T. 27 S., R. 1 W.	Brown sand, 0 to 18 inches.	0.82	0.16	5.14	15.90	52.90	20.14	3.26	2.92
6923	N. $\frac{1}{2}$ sec. 11, T. 27 S., R. 1 W.	.....do .....	.73	2.92	14.94	19.96	33.90	17.64	5.50	4.88
6924	Subsoil of 6923 ....	Sand, 18 to 72 inches.	.19	2.66	12.16	27.08	44.90	9.22	1.96	1.64
6926	Subsoil of 6925 ....	Yellowish-brown sand, 18 to 36 inches.	.80	.14	2.62	11.66	49.88	24.42	6.40	4.82

## MIAMI FINE SAND.

To an average depth of 12 inches the Miami fine sand consists of a rather loose brown sand, medium to fine in texture, though somewhat coarser phases are sometimes met with. From 12 to 36 inches the subsoil is usually a dark fine sandy loam, interstratified with layers of sand and gray to brown sandy clay. A thin stratum of black fine sandy loam of from 4 to 6 inches in thickness and occurring at from 1 to 3 feet in depth is a prominent characteristic of the subsoil of this type. Below 3 feet strata of loose, incoherent yellow sand are found. In the bands of clay which are interbedded with these strata of sand a few small lime concretions are sometimes seen.

This soil occurs immediately along the banks of the Arkansas River, the larger area lying on the western side. Its contact with the Miami sand is nowhere sharp—in fact, is rarely perceptible from surface indications. Though the average texture of the soil of this type is finer than in the case of the Miami sand, the presence of the heavier material in the subsoil is made the basis for classification. The surface is usually flat, except for the occasional occurrence of low sand dunes. These rarely exceed 4 feet in height, except on the banks of the river, where they are generally much higher. Strictly, these higher dunes at the river bank do not belong with this type of soil, but are rather examples of “dune sand.” The area which they cover is too small, however, to be plainly indicated on the map as a separate soil type. No artificial drainage is required, the proximity to the river and the natural porosity of the soil and subsoil serving to carry away surplus surface water.

This soil, like the Arkansas loam, is formed by the deposition of river sediments, the only difference in the derivation of the two types being that the Miami fine sand has been formed by the drifting of the dune sand over the loam.

The soil is especially well adapted to truck raising and is in demand for the cultivation of most varieties of fruit. It seems an ideal melon soil, and apples and peaches bear heavily. Some corn and wheat are grown upon the soil, but its greatest capabilities lie in the direction of market gardening.

The table on the following page contains mechanical analyses of the soil and subsoil of this type.

*Mechanical analyses of Miami fine sand.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
6897	NE. $\frac{1}{4}$ sec. 16, T. 29 S., R. 1 E.	Brown sand, 0 to 16 inches.	1.11	0.74	3.24	8.24	35.94	22.64	23.84	5.34
6895	SW. $\frac{1}{4}$ sec. 13, T. 27 S., R. 1 W.	Sand, 0 to 12 inches.	1.57	.18	7.08	14.04	32.38	19.44	19.04	7.84
6898	Subsoil of 6897.....	Grayish-yellow sand, 16 to 36 inches.	1.23	.20	1.18	5.94	31.34	29.38	26.02	5.88
6896	Subsoil of 6895.....	Sandy loam, 12 to 36 inches.	1.04	.16	5.10	13.02	32.80	17.60	18.70	12.40

## SEDGWICK BLACK CLAY LOAM.

The soil of the Sedgwick black clay loam to a depth of 12 inches is a fine-grained, black silty loam. The texture at the surface is occasionally somewhat heavier, and the color sometimes approaches a gray. The subsoil is a heavy, tough, bluish-gray to drab clay, extending to 3 feet or more and sometimes containing a small amount of very fine sand or coarse silt. At 3 feet the subsoil is very dry and is penetrated with difficulty. The type occupies flat or basinlike depressions in the upland prairie and is best developed in the southwestern part of the area. It has no adequate drainage. The soil has been formed from the washing down of the finer particles of silt and clay from the surrounding upland soils. It is generally left for pasturage, though thorough drainage converts it into land well adapted to wheat and corn.

The following table gives the result of mechanical analyses of a sample of the soil and subsoil of this type:

*Mechanical analyses of Sedgwick black clay loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
6919	N. $\frac{1}{4}$ sec. 12, T. 29 S., R. 1 W.	Heavy silty clay loam, 0 to 16 inches.	1.50	0.26	1.04	1.34	8.26	30.80	48.08	9.14
6920	Subsoil of 6919.....	Heavy clay or silt, 16 to 36 inches.	.92	Tr.	.60	.64	1.44	15.10	51.60	30.94

## CLARKSVILLE STONY LOAM.

To a depth of about 9 inches the Clarksville stony loam is a yellowish-brown to a brown silty loam, rather loose in texture, and containing from 10 to 20 per cent of limestone and chert fragments. The fragments of limestone range in size from an inch to a foot or more in diameter, and are irregular in shape; the chert is very sharp and angular, and the pieces are from one-fourth inch to 2 inches in diameter. The subsoil usually overlies the bed rock to a thickness of 20 inches or a little more, and is a yellowish-brown clay loam. Contained in it are a good many pieces of limestone, often partially decomposed. Nodular masses of siliceous material, like coarse-textured chert, are not uncommon in the subsoil, ranging from one-half inch to 2 inches in diameter.

This type is found scattered about in small areas in the eastern part of the area in Butler County. It occupies high ridges, and especially hillsides along streams and ravines, particularly the Walnut River and its tributaries, where the underlying stratified rock occurs in loose blocks. It is also found, in a few instances, as small knoblike hills composed of broken pieces of chert and limestone intermixed with the soil. It is derived from the degradation of limestone of the Permian formation. It differs from the Sedgwick black clay loam in being less completely weathered, and in the fact that it contains less organic matter. It is usually too thin and stony to have much agricultural value, but makes good pasture land. The cherty phase of this type would doubtless make a good fruit soil.

The following table gives the results of the mechanical analyses of the soil and subsoil:

*Mechanical analyses of Clarksville stony loam.*

[Fine earth.]

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
6905	E. $\frac{1}{4}$ sec. 13, T. 27 S., R. 4 E.	Loam, 0 to 9 inches.	<i>P. ct.</i> 4.00	<i>P. ct.</i> 1.66	<i>P. ct.</i> 0.80	<i>P. ct.</i> 1.60	<i>P. ct.</i> 2.32	<i>P. ct.</i> 15.94	<i>P. ct.</i> 65.14	<i>P. ct.</i> 12.46
6903	NW. cor. sec. 11, T. 27 S., R. 3 E.	.....do .....	3.96	.62	.96	1.58	2.00	15.04	63.88	15.92
6906	Subsoil of 6905.....	Brown clay loam, 9 to 18 inches.	1.70	.90	2.18	1.34	2.08	10.64	64.08	18.60
6904	Subsoil of 6903.....	Clay loam to clay, 9 to 30 inches.	1.12	1.26	1.94	1.32	2.10	5.20	48.58	39.30

## SEDGWICK SANDY LOAM.

The soil of the Sedgwick sandy loam is 10 inches deep and is composed of medium to fine reddish-brown or chocolate-brown sand, carrying considerable organic matter. It is a friable, easily cultivated soil and shows no tendency to form clods. From 10 to 20 inches the subsoil is a reddish-brown, sticky sand, and from 20 inches downward to 36 inches or more this becomes a heavy sandy clay. The sand in this material consists mainly of grains of feldspar and quartz. The type is found mainly in sections 4 and 9 of Delano Township, which lies in the northwestern part of the area. About a square mile of this soil was also mapped a mile or two to the northeast of Clearwater.

The Sedgwick sandy loam occupies a high, gently rolling position on the upland, and in Delano Township forms a low, fairly well-defined escarpment at its junction with the Arkansas River Valley. The drainage of the soil is excellent.

The soil is derived from the weathering of unconsolidated deposits of Tertiary age. It is adapted to corn and wheat and other grains. Fruit does well upon it, and it should prove a good soil for the culture of potatoes and farm vegetables in general.

The following table gives the results of the mechanical analyses of typical samples of soil and subsoil of this type:

*Mechanical analyses of Sedgwick sandy loam.*

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
6921	N. $\frac{1}{4}$ sec. 9, T. 27 S., R. 1 W.	Dark-brown sand, 0 to 10 inches.	P. ct. 1.40	P. ct. 0.34	P. ct. 8.88	P. ct. 18.54	P. ct. 32.12	P. ct. 18.50	P. ct. 13.98	P. ct. 6.98
6922	Subsoil of 6921 .....	Heavy sand, 10 to 36 inches.	1.15	.30	6.84	13.68	27.42	13.58	17.18	21.04

## AGRICULTURAL METHODS.

The system of planting and harvesting crops on the Plains differs somewhat from that which obtains in those parts of the country where land is not so easily cultivated, where farms are smaller, and where the acreage allotted to each crop is considerably less. In this area the principal crops, corn and wheat, are usually planted in lots of not less than 40 acres, and the ground being entirely free from stumps and

stones and so nearly level, it is possible to dispense almost entirely with hand labor. Nearly all the implements used in the cultivation of these two crops are made to be ridden by the driver, though a few walking plows are still in use.

The practice is extensively followed of planting corn with a lister, which method is claimed to be better adapted to the peculiar climatic conditions of the country than the method of planting on a flat surface, as with the check rower. The lister is simply a plow having two moldboards and throwing the earth in both directions. In the bottom of the wide furrow thus made a narrow subsoil shovel travels directly in front of the planter and prepares a mellow trough for the reception of the grain. When the corn is well up and the roots are well formed the ridges are gradually worked into the furrows with a special cultivator or with a sled provided with fenders for the protection of the young plant, so that by the time the stalks are 2 feet high the surface of the field is as level as one in which a check rower has been used. The lister, of course, plants the corn in loose drills rather than in hills. The advantages claimed for this system of planting are that no previous plowing or preparation of the field is necessary, whereby extra labor is saved, and that by reason of the roots being made to grow from 2 to 4 inches deeper in the soil the plant is much better able to withstand drought. For harvesting the use of the corn binder, though not universal, is quite general.

The methods of sowing and harvesting wheat do not differ materially from those followed in other States. With the exception of thrashers, nearly every farmer owns all of the farm machinery which he uses, such as mowers, binders, drills, listers, cultivators, etc.

The soils of Kansas are as yet so productive that but few agriculturists have seen the necessity or advisability of the application of farm manures or commercial fertilizers, and the practice of green manuring and crop rotation is almost unknown. The time will soon come when the present improvident methods must be abandoned and measures taken for restoring to the soil the fertility which the present system of the continuous cultivation of one crop on the same ground year after year inevitably drains from it.

The only irrigation in the area is practiced by a few market gardeners. They have built small reservoirs, which they fill by means of windmills, and from which small vegetable gardens are irrigated. Legal proceedings are at present in progress looking to the curtailment of the amount of water taken from the Arkansas River for irrigation purposes by the farmers in eastern Colorado, and to the consequent increase of the supply that will reach the farmers of Kansas. In this immediate locality it is doubtful if this water will be used for direct irrigation at present; it is wanted more particularly for the subirrigation which is afforded by the Arkansas River in its own flood plain.

## AGRICULTURAL CONDITIONS

Though Kansas was formerly most widely known for her cattle-grazing interests, her rich and varied agricultural resources were long ago recognized, and for many years she has taken a front rank among the great cereal-producing States. The area selected for the soil survey is one of the richest in the State. The farmers are prosperous and their indebtedness is slight, the majority of them owning and operating their own farms. The farms were originally preempted, and, as a rule, are held in quarter sections, but farms containing 320 acres are not rare, while some of them have an even greater acreage. A few are owned by nonresidents and by retired farmers living in the towns. These are operated by resident tenants, some of whom pay a yearly cash rental ranging from \$1.50 per acre upward, while others receive for their labor, tools, seed, etc., from three-fifths to two-thirds of the crops harvested. Hired laborers are all white, most of them American born, and they can be had in fair abundance at a monthly wage of from \$18 to \$20. The use of highly improved modern machinery makes it possible for the farmer's boy in many cases to do the work of a hired man, so that, in general, hired help is not required by the average farmer except during the three or four busiest months of the season. Through the season of harvesting and thrashing labor of a transient class is usually readily secured at an average wage of about \$1.50 a day with board.

Corn and wheat are the crops most extensively grown in the area. In 1899 the acreage of corn in Sedgwick County was 30 per cent, while wheat covered 20 per cent of the entire area of the county. In the same year 42,000 acres of oats were also harvested, while about 7,000 acres each of alfalfa and Kafir corn were cut. Much more alfalfa would be grown if it were not that the soils of the upland do not seem well adapted to it. Kafir corn seems to be excellently adapted to the soil and climatic conditions of the area. This crop is growing in favor, and the acreage is rapidly increasing. Sorghum is also grown to some extent as a forage crop, and by some is preferred to Kafir corn.

It is believed that the profits to be secured from dairying are not sufficiently appreciated. But one or two creameries exist within the area, though there are two or three in adjoining territory. Farmers who have patronized the creameries are as a rule well pleased with their returns, and there is little doubt that a few more creameries would find a field once the farmers became aware of the increased income to be derived from this disposition of their milk as compared with returns from the old method of making butter on the farm. The complaint is sometimes heard of the insufficiency of green forage during the later summer months, due to the inability of the native grasses

to withstand the hot, dry season. This difficulty can, of course, be overcome by those farmers owning bottom land on the streams, where alfalfa can be readily grown. On the uplands Kafir corn rarely, if ever, fails. It is believed that if greater acreage were given to this crop, and the fodder cut green and preserved in silos, an abundance of feed for dairy stock might be secured at no great expense. The uncertainty of always being able to secure a good harvest of corn or wheat makes it highly desirable that farmers should have some other source of revenue, such as a good herd of dairy cattle or a well-kept and productive orchard.

While apples and peaches yield fairly on the upland soils, there is evident recognition of the superior adaptability of the valley soils for this class of fruit. Upon the Miami sand and Miami fine sand many apple orchards of from 10 to 20 acres and more are to be seen. The trees are thrifty, yield prolifically, and do not seem to be troubled to any great extent by insect pests. Upon the valley loam (the Arkansas loam) grapes give abundant yields, and the common varieties are cultivated to quite an extent. The same soil produces tomatoes of marked superiority. Wichita furnishes a ready market for all kinds of fruits and vegetables, and this demand, combined with that which will be afforded by a canning establishment soon to be erected in Wichita, should encourage the further extension of general gardening and horticulture.

The investigation of the adaptability of the soils—particularly the Arkansas loam—to the profitable growing of the sugar beet is now in progress under the direction of an expert, and it is expected that gratifying results will be shown. If the soil and climate proves favorable a profitable industry can be built up in the Arkansas River valley in the immediate vicinity of the city, where labor is cheap and near at hand.

Transportation facilities throughout the area are unusually good. There are about 110 miles of railroad, operated by four different systems. The seven different lines are so well distributed that no point in the area is more than 9 miles from a station. Wichita is one of the most important shipping points in its relation to Oklahoma, Indian Territory, and northern Texas. The wagon roads of the area are laid out on the rectangular system, following section lines. During rainy weather many of the roads become very heavy, and the sticky soil adheres to the wheels of vehicles to such an extent as to nearly double the draft. The mud is not excessively deep, however, and the nature of the soil is such that when thoroughly dried a firm, hard roadbed results. No toll roads exist.

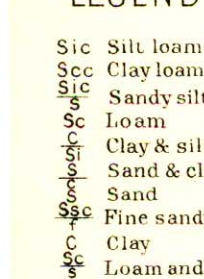
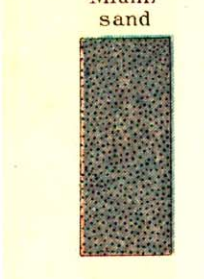
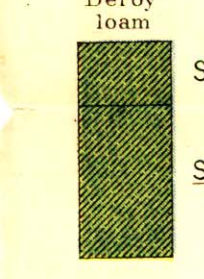
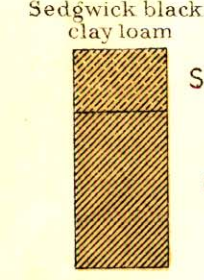
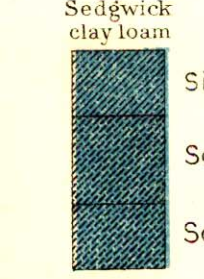
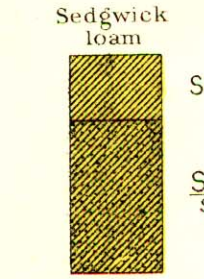
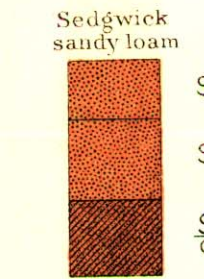
# NRCS Accessibility Statement

---

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at [ServiceDesk-FTC@ftc.usda.gov](mailto:ServiceDesk-FTC@ftc.usda.gov). For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

SOIL  
PROFILE  
(3 feet deep)



LEGEND

